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(54) IMPROVEMENTS IN OR RELATING TO PNEUMATIC TYRES AND WHEEL ASSEMBLIES

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Upon pneumat the runn the inte assembly come into contact with one another under more or less load according to whether or not the deflation is complete; the regions of the interior surface which normally come into contact are the region of the tyre close to but radially outwardly of the rim flanges and the regions of the tyre close to but axially inwardly of the tread edge.

When the regions come into contact considerable heat is generated within the rubber and textile components of the tyre and very rapid structural failure ensues.

This difficulty may be reduced or obviated by the use of lubricant as described in our U.K. Patent Specification No. 1,359,467. As mentioned in this specification it is desirable to seal the puncture in order that some internal pressure may be re-established e.g. by vaporisation of one or more components of the lubricant.

According to the invention there is provided a pneumatic tyre and wheel assembly containing a lubricant composition for lubricating the region of the internal surface of the assembly which contact when the tyre is in use in a deflated condition, said lubricant composition including a volatile component which volatilises at the temperature generated when the assembly is driven deflated to at least partially reinflate the tyre and a puncprising particles material and/or inding plastics lastics material iat of the com- 1.3.

spect of the in- lubricant com- regions of the wheel assembly, the assembly is composition in- (as herein before ly reinflate the sealing material comprising particles formed by shredding plastic material and/or plastics formed by grinding plastics material.

In use of the lubricant composition, the puncture sealing material is to seal a puncture in the tyre of a tyre and wheel assembly and the volatile ingredient vaporises due to the heat generated by flexure and friction within the assembly and thereby cause partial reinflation of the tyre.

Preferably the shredded plastics material comprises low density polyethylene film. The preferred maximum particle size of the shredded polyethylene is such that the particles will just pass through a sieve having 3 mm opertures, but more preferably the material should have a particle size from about 1.7 mm. (10 mesh sieve: B.S. 410 published 1969) down to fines, e.g. about 100 microns. The preferred thickness of the polyethylene film is 75 microns, although other thicknesses may be used.

Preferably the ground plastics material comprises polystyrene foam of the same particle size range as the shredded polyethylene.

The shredded and/or ground plastics material may advantageously be used in combination with nylon fibres which are preferred to have a length of 1 to 3 mm. and a

denier in the range 1 to 6. In a further alternative the shredded and/or ground plastics material may be used in combination with vulcanised rubber in shredded or ground form and having a size range same as that of the plastics material.

The puncture sealing material may be loose within the inflation chamber, formed by the tyre and wheel assembly whilst the remainder of the lubricant composition is held in an enclosing means. Alternatively the puncture sealing material may be loose within the inflation chamber together with one or more other ingredients of the lubricant composition. In the latter case it is preferable to provide means to enclose at least the volatile ingredient of the lubricant composition the enclosed ingredient(s) being automatically releasable from the enclosing means upon deflation of the assembly during running. One particularly convenient form of this latter case is a lubricant composition comprising a gel ingredient in which the puncture sealing material is carried and a dilatant ingredient enclosed in enclosing means. The dilatant ingredient can be either enclosed with or separately from the volatile ingredient.

In a further alternative embodiment the entire lubricant composition, may be enclosed in enclosing means such as are disclosed in our U.K. Patent Specification No. 1,359,461.

The present invention further provides a pneumatic tyre and wheel assembly containing a lubricant composition for lubricating the regions of the internal surface of the assembly which contact when the assembly is driven deflated, said lubricant composition including a volatile component which volatilises at the temperature generated when the assembly is driven deflated to at least partially re-inflate the tyre and a puncture sealing material, said puncture sealing material comprising a foamed plastics material said material being attached to the interior surface of the tyre and being in strip form, the strip being so located that on deflation of the assembly, the foamed plastics material will be ground up between the contacting regions of the tyre.

A suitable foamed plastics material is polyurethane foam.

Examples of lubricant compositions for use in the present invention may comprise lubricant compositions described in our U.K. Patent Specification No. 1,359,467, and additionally including the puncture sealing material(s).

The pneumatic tyre is preferably a pneumatic tyre of relatively low aspect ratio e.g. 50 per cent to 75 per cent having a tread reinforced by a breaker assembly, and preferably also a radial ply carcass. Advantageously the tyre may also have a tread wider than the distance between its bead heels when mounted on the rim in the tyre/wheel assembly.

Preferably the tyre is of the type described in U.K. Patent Specification No. 1,408,567 in which the stiffness of the tread and sidewall structure together with the width of the tread is such that when in use with the tyre deflated or substantially deflated and subject to a substantial lateral force one of the said sidewalls will be placed under tension in the region of the contact patch to restrain the bead from lateral movement while the other sidewall will be disposed in a folded state in the said region so as to be capable of acting as a buffer between a tyre bead retaining flange on a wheel rim on which the tyre is mounted and a road surface. It is important in the use of such a tyre that the beads should remain on the rim when the tyre is deflated, and further should not be able to fall into a well on the wheel rim. Thus, a wheel rim without a well should be used, e.g. a split rim or a rim in which the well has been closed up by axial compression of the wheel after the tyre has been mounted thereon and restraining means should be provided to prevent axial movement of the beads away from the bead seats, e.g. a bead spacer ring, spacer units or projections on the wheel rim.

An example of lubricant compositions used in conjunction with the puncture sealing material and the results obtained therefrom is given below:—

EXAMPLE

A round hole was drilled with a 3/64 inch (1.19 mm) drill in the centre groove of an uninflated new 185—60—13 tyre on a split rim 3½ inches wide between flanges. To ensure that the inside of the hole was uniform and not partially blocked a red-hot thin wire was pushed through several times from outside. The valve insert was removed and the following materials were inserted through the valve hole:

Liquid—300 ml blend consisting of		
Ucon 50—HB—5100 × ex Union Carbide	231 ml	
Water	46 ml	
74 over proof ethyl alcohol	23 ml	
Solids— Polythene film, 75 microns thick shredded (chopped up) into pieces of varying particle size but all having passed through a British Standards Institute test sieve of aperture size 1.70 mm (Ref. BS 410).	15 g	
Nylon fibres, 1 mm long, denier 3	1.5 g	

The valve insert was then replaced but the tyre was left deflated to simulate the situation just after a puncture. The car (Ford Escort) was now driven at approximately 50

mph up and down a straight length of track, cornering at each end alternately right and left. The car was stopped at intervals, the pressure was recorded and the puncture hole was examined for leakage.

Ucon and Ford are Registered Trade Marks.

Distance	Pressure	Leakage
2 miles	1.5 psi	None
5 miles	3 psi	None
10 miles	4 psi	Slight
20 miles	4 psi	None
30 miles	4.5 psi	Slight
40 miles	4.5 psi	Slight

The car was now left overnight and the testing recommenced next day.

Distance	Pressure	Leakage
42 miles	2.5 psi	None
45 miles	4 psi	None
50 miles	5 psi	None

A sharp metal object was now inserted through the puncture hole to break the temporary seal, and the pressure dropped to zero. The test was continued to see if sealing was re-established.

Distance	Pressure	Leakage
52 miles	4.5 psi	Slight
55 miles	4.5 psi	Slight
60 miles	4.5 psi	None
70 miles	4.5 psi	Slight

The sharp metal object was again inserted through the puncture hole, the tyre went flat, and driving re-commenced.

Distance	Pressure	Leakage
72 miles	3 psi	Slight
75 miles	3 psi	Slight
80 miles	3.5 psi	None

For a third time the seal was caused to break by inserting the sharp metal object through the hole and deflating the tyre. Driving then continued.

Distance	Pressure	Leakage
82 miles	1.5 psi	None
85 miles	2.5 psi	Slight
90 miles	3.5 psi	Slight
100 miles	4.5 psi	Slight

The test was concluded after having demonstrated that a crown centre hole of diameter 1.19 mm is sealable by the lubricant composition, that a small but valuable internal pressure in the tyre thus sealed can be re-established and that the lubricated tyre/wheel assembly can run for 100 miles at 50 mph.

WHAT WE CLAIM IS:—

1. A pneumatic tyre and wheel assembly containing a lubricant composition for lubricating the regions of the internal surface of the assembly which contact when the tyre is in use in a deflated condition, said lubricant composition including a volatile component which volatilises at the temperature generated when the assembly is driven deflated to at least partially re-inflate the assembly and a puncture sealing material comprising particles formed by shredding plastics material and/or particles formed by grinding plastics material.

2. An assembly according to claim 1 wherein said plastics material has a density relative to that of the composition in the range 0.7 to 1.3.

3. An assembly according to claim 1 or 2 wherein the plastics material to be shredded comprises low density polyethylene film.

4. An assembly according to claim 1 or 2 wherein the plastics material to be ground comprises polystyrene foam.

5. An assembly according to claim 3 or 4 wherein the maximum particle size of the puncture sealing material is such that the particles will just pass through a sieve having 3 mm apertures.

6. An assembly according to claim 3 or 4, wherein the puncture sealing material has a particle size in the range 100 microns to 1.7 mm.

7. An assembly according to claim 3, or claim 5 or 6 when dependent on claim 3, wherein the polyethylene film has a thickness of 75 microns.

8. An assembly according to any one of the preceding claims wherein the puncture sealing material includes nylon fibres.

9. An assembly according to claim 8 wherein the nylon fibres have a length of 1 to 3 mm and a denier in the range 1 to 6.

10. An assembly according to any one of the preceding claims wherein the puncture sealing material includes particles formed by shredding and/or particles formed by grinding vulcanised rubber.

11. An assembly according to claim 10 wherein the particles formed by shredding and/or grinding rubber have the same size as the particles formed by shredding and/or grinding plastics material.

12. An assembly according to any one of the preceding claims wherein the puncture sealing material is loose in the inflation chamber formed by the assembly, the remainder of the lubricant composition being held in an enclosing means, the enclosing means being automatically opened on deflation of the assembly during running to release said remainder of the lubricant composition.

13. An assembly according to any one of Claims 1 to 11, wherein the puncture sealing material and at least one other ingredient of

the lubricant composition are loose in the inflation chamber formed by the assembly.

14. An assembly according to Claim 13, wherein the volatile component of the lubricant composition is held in an enclosing means, the enclosing means being automatically opened on deflation of the assembly during running to release said volatile component.

15. An assembly according to Claim 13 or 14, wherein the ingredient or ingredients loose in the inflation chamber comprises a gel in which the puncture sealing material is carried, the assembly further including means to enclose a dilatant ingredient.

16. An assembly according to any one of Claims 1 to 11, wherein the entire lubricant composition is held in an enclosing means, the enclosing means being automatically opened on deflation of the assembly during running to release said lubricant composition.

17. A pneumatic tyre and wheel assembly containing a lubricant composition for lubricating the regions of the internal surface of the assembly which contact when the assembly is driven deflated, said lubricant composition including a volatile component which volatilises at the temperature generated when the assembly is driven deflated to at least partially re-inflate the assembly and a puncture sealing material, wherein the puncture sealing material comprises a foamed plastics material, said material being attached to the interior surface of the tyre and being in strip form, the strip being so located that on deflation of the assembly the foamed plastics material is ground up between contacting regions of the tyre.

18. An assembly according to any one of the preceding claims, wherein the pneumatic tyre has an aspect ratio in the range 50—75%.

19. An assembly according to any one of the preceding claims, wherein the tyre has a tread wider than the distance between the tyre bead retaining flanges on the wheel rim of the assembly.

20. A lubricant composition for lubricating the regions of the internal surface of a tyre and wheel assembly, which regions contact when the assembly is driven deflated, the lubricant composition including a volatile component which volatilises at the temperature generated when the assembly is driven deflated to at least partially re-inflate the assembly and a puncture sealing material comprising particles formed by shredding plastics material and/or particles formed by grinding plastics material.

21. A composition according to claim 20 wherein said plastics material has a density relative to that of the composition in the range 0.7 to 1.3.

22. A composition according to claim 20 at 21 wherein the plastics material to be shredded comprises low density polyethylene film.

23. A composition according to claim 20 or 21 wherein the plastics material to be ground comprises polystyrene foam.

24. A composition according to claim 22 or 23 wherein the maximum particle size of the puncture sealing material is such that the particles will just pass through a sieve having 3 mm apertures.

25. A composition according to claim 22, or 23 wherein the puncture sealing material has a particle size in the range 100 microns to 1.7 mm.

26. A composition according to claim 22, or claim 24 or 25 when dependent on claim 22, wherein the polyethylene film has a thickness of 75 microns.

27. A composition according to any one of claims 20 to 26 wherein the puncture sealing material includes nylon fibres.

28. A composition according to claim 27 wherein the nylon fibres have a length of 1 to 3 mm and a denier in the range 1 to 6.

29. A composition according to any one of claims 20 to 28 wherein the puncture sealing material includes particles formed by shredding and/or particles formed by grinding vulcanised rubber.

30. A composition according to claim 29 wherein the particles formed by shredding and/or grinding rubber have the same size as the particles formed by shredding and/or grinding plastics material.

31. A pneumatic tyre and wheel assembly according to claim 1 substantially as described herein.

32. A pneumatic tyre and wheel assembly, substantially as described herein with reference to the Example.

33. A lubricant composition according to claim 20 substantially as described herein.

34. A lubricant composition, substantially as described herein with reference to the Example.

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